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Torres Strait Dugong Sanctuary Seagrass Baseline Survey

March 2010

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Australian Government

Torres Strait Regional Authority

Toward Q2 Tomorrow's Queensland

Queensland Government

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EXECUTIVE SUMMARY

The March 2010 baseline survey was the most comprehensive assessment of seagrass distribution and abundance that has been conducted within the Dugong Sanctuary. The sanctuary contained the largest single continuous seagrass meadow recorded in Australia and was likely to provide an important food resource for dugong and turtle populations. Seagrass species found included those known to be important for dugong and turtles as well as nursery grounds for commercial fisheries species.

Results from this baseline survey indicate that the location of the Dugong Sanctuary is appropriate from a seagrass perspective with the majority of the area containing seagrass that would be suitable as a food resource for dugong. The large area of seagrasses mapped also provides an important source of primary production supporting the regions marine ecosystem.

Seagrass was found at 73% of sites surveyed and occurred down to a depth of 29.7m below mean sea level. One large seagrass meadow of 875,244 ha was mapped with an average seagrass percent cover of 6%. Mean above-ground biomass of the seagrass meadow was 2.03 ± 0.51 g DW m^{-2}. This seagrass meadow was the largest continuous area of seagrass that has been mapped in Australia.

The baseline survey and subsequent monitoring program provide a reference point to assess future seagrass changes and levels of resilience, as well as developing an appreciation of the natural ranges of seagrass change. This information will allow the development of effective management options to protect these valuable habitats and information on potential flow on effects to dugong and turtle relying on these seagrasses as a food resource.

INTRODUCTION

Background

Torres Strait was created as an island archipelago approximately 9,000 years ago as a result of the post-glacial sea level rise and consequent inundation of the Sahul Shelf — the land bridge connecting Australia with PNG (Barham and Harris 1983; Harris et al. 2008). The Strait covers some 48,000 km^2, is mostly shallow (predominately less than 15m deep) and has numerous continental and volcanic islands, coral cays, mangroves, and complex coral reef systems as well as extensive seagrass beds (Coles et al. 2003).

Eighteen of the 247 islands in the Torres Strait are permanently inhabited. The inhabited islands are separated into four distinct regional groups: high continental Western Islands; swampy Top Western Islands adjacent to the Papua New Guinea mainland; low, sandy, Central Island group; and volcanic Eastern Islands (Harris et al. 2008; Johannes and MacFarlane 1991). Local island communities in the Torres Strait are deeply connected to their sea country through their culture, economy, spirituality and social way of life. The health of their marine resources has been, and continues to be, vital to Torres Strait Islanders from a subsistence and cultural point of view.

In 1985, Australia and Papua New Guinea ratified the Torres Strait Treaty to resolve the maritime boundaries in this region. The Treaty established the Torres Strait Protected Zone and provided a framework for the management, conservation and sharing of fisheries resources in the region, whilst aiming to acknowledge and protect the traditional way of life and livelihood of the Torres Strait Islanders. The Treaty requires the two governments to protect and preserve the marine environment and indigenous flora and fauna. A segment of the Torres Strait Protected Zone and adjacent area was designated as a Dugong Sanctuary, in which all hunting of dugong was banned from 1985. The Dugong Sanctuary covers an area in excess of 1.3 million hectares in the western Torres Strait region, from parallel to Latitude 11°10’ South, north to the Fisheries Jurisdiction line between Papua New Guinea and Australia in the north.

Very little information is known on the distribution and abundance of important subtidal seagrass habitat within and around the Dugong Sanctuary, despite the value of these habitats as an important food source for dugong and turtle. Subtidal seagrasses have been studied at nearby Badu and Mabuiag Islands and the Orman Reefs where an extensive coverage of highly diverse seagrasses were identified as one of the most important areas of seagrass habitat in the Torres Strait and Queensland for dugong (Rasheed et al. 2006; Chartrand et al. 2009). The above ground productivity of Orman Reef seagrass meadows was high compared with other tropical seagrass communities, indicating that the habitat is of key importance to fisheries, dugong and turtle and carbon cycling in the central Torres Strait (Rasheed et al. 2008).

The importance of Torres Strait seagrasses

The importance of seagrasses as structural components of coastal ecosystems is well recognised. Seagrass/algae beds have been rated the third most valuable ecosystem globally (on a per hectare basis) for ecosystem services, preceded only by estuaries and swamps/flood plains (Costanza et al. 1997).

The Torres Strait is estimated to contain between 13,425km^2 (Coles et al. 2003) and 17,500km^2 (Poiner and Peterkin 1996) of seagrass habitat, providing critical habitat for commercial and traditional fishery species as well as important food resources for endangered dugong and green turtle populations (Marsh and Kwan 2008; Sheppard et al. 2008; Coles et al. 2003). The largest population of dugongs in the world is in Torres Strait (Marsh et al. 1997, 2002), where the long-standing importance of dugongs for subsistence by Torres Strait Islanders has been traced in archaeological deposits dating back at least 2000 years (Vanderwal 1973). For the Indigenous people of Torres Strait, dugong is the most significant and highest ranked marine food source in the traditional subsistence economy (Nietschmann 1984; Raven 1990; Johannes and MacFarlane 1991; Kwan 2002).

The dynamics of seagrasses in Torres Strait may be strongly influenced by extremes in weather. Studies have shown substantial seagrass dieback (up to 60%) on two occasions in central Torres Strait (Long and Skewes 1996; Marsh et al. 2004). The causes for these diebacks are unclear. Although suggested to be the result of flooding (Long and Skewes 1996), recent investigations have shown that neither the movements of large sandbanks nor turbidity from rivers on the south coast of Papua New Guinea are likely to affect seagrass communities of Torres Strait on a regional scale (Daniell et al. 2006). Nevertheless, these diebacks have been linked to declines in the population of dugong (Marsh et al. 2004).

Despite the considerable ecological and economical value of the Torres Strait marine ecosystem, the subtidal benthic communities remain understudied. Limited broad-scale assessment of subtidal benthic habitats were undertaken in 2005 (Sheppard et al. 2008) and 1995 (Long and Poiner 1997) and identified seagrass as an important component of these regions. These studies, however, provided only a snapshot of seagrass species distribution and abundance, as survey sites were limited and spread out over large distances. Lack of detailed, fine-scale studies, which map and quantify seagrass abundance in the Torres Strait has limited our ability to predict the consequences of disturbances on seagrass habitats and their associated ecosystems and fisheries. This is especially relevant within the Dugong Sanctuary, a largely subtidal area set aside for the protection of Dugong. Prior to this baseline survey there has been relatively little data available on the extent of seagrass within the Dugong Sanctuary as well as its suitability as food for dugong.

Sampling approach

A lack of information on the distribution and abundance of seagrass, coupled with reported low density of dugongs in the Dugong Sanctuary, have raised questions about the efficacy of the sanctuary as a component of management for dugongs in the region. A baseline survey provides important information on overall habitat diversity, areas considered high environmental value and areas best suited for long term monitoring by rangers. The Fisheries Queensland Marine Ecology Group in collaboration with the Torres Strait Regional Authority (TSRA) Land and Sea Management Unit launched a program to deliver the baseline information on the subtidal seagrass and algae habitat within and immediately surrounding the Dugong Sanctuary with a focus on seagrass communities. Our assessments were focused on describing these more extensive and under-described areas.

The specific objectives of the present study were to:

1. Conduct a baseline survey of subtidal seagrass and algae distribution and abundance within and around the Dugong Sanctuary; and
2. Provide information on the importance of Dugong Sanctuary marine habitats to dugong, turtle and local fisheries.

METHODS

Sampling methods

The baseline survey was conducted between the 23rd March to the 2nd April 2010. Sampling methods applied were based on existing knowledge of seagrass distribution by local rangers and Traditional Owners and physical characteristics of the area such as depth, visibility, logistical and safety constraints.

The survey area encompassed all subtidal areas within and surrounding the existing Dugong Sanctuary limits. Due to the large area that was surveyed a stratified sampling approach was undertaken. Sampling was more intense within areas that were found to contain seagrasses and more spread out in deeper regions where seagrass was largely absent.

At each transect site an underwater CCTV camera system with real-time monitor was towed from the Fisheries research vessel "*Gwendoline May*". For each transect the camera was towed for 100 metres at drift speed (less than one knot). Footage was observed on a TV monitor and recorded to digital tape. The camera was mounted on a sled that incorporated a sled net 600 mm width and 250 mm deep with a net of 10 mm-mesh aperture (Plate 1). Surface benthos was captured in the net (semi-quantitative bottom sample) and used to confirm seagrass, algal and benthic macro-invertebrate (BMI) habitat characteristics and species observed on the monitor. A Van Veen sediment grab was used to confirm seagrass species identification and sediment type. This method has been used extensively by the Marine Ecology Group (MEG) for deepwater benthic surveys in the Ports of Abbot Point, Hay Point Mackay and Gladstone (see Rasheed et al. 2001; 2003; 2004; 2005; 2007) as well as throughout the Great Barrier Reef Lagoon and other locations off the Queensland coast (Coles et al. 1996; 2002). This technique ensured a large area of seafloor (approximately 60m^2 per transect) was sampled at each site so that patchily distributed marine plant and BMI habitats that typifies deepwater habitats were effectively measured.

Habitat characterisation sites

Data recorded at each site included:

1. **Seagrass species composition** – Seagrass identifications in the field and from video according to Kuo and McComb (1989). Species composition measured from the sled net sample and from the video screen when species are distinct.

2. **Seagrass biomass** – Above ground biomass was determined using a modified "visual estimates of biomass" technique described by Mellors (1991) and was based on ten random time frames allocated within the video footage for each transect site. The video was paused at each of the ten random time frames selected then advanced to the nearest point on the tape where the bottom was visible and sled was stable on the bottom. From this frame, an observer recorded an estimated rank of seagrass biomass and species composition. To standardise biomass estimates, a 0.25 m^2 quadrat scaled to the video camera lens used in the field, was superimposed on the screen. Where seagrass was present in the sled net but not visible in the transect's video footage, the lowest biomass rank (0.05) was assigned to one of the 10 ranks for the transect. On completion of the videotape analysis, the video observer ranked five additional quadrats that had been previously videoed for calibration. These quadrats were videoed in front of a stationary camera, and then harvested, dried and weighed. A linear regression was calculated for the relationship between the observer ranks and the actual harvested value. This regression was used to calculate above ground biomass for all estimated ranks made from the survey sites. Biomass ranks were then converted into above ground biomass estimates in grams dry weight per square metre (g DW m^{-2}) (see Rasheed et al. 2001; 2003; 2004; Coles et al. 1996; 2002).

3. **Algae** – Presence/absence, algae type and percent cover (identified according to Cribb 1996). Percent cover was estimated from the video grab. Algae collected in the sled net and grab will provide a taxa list.
    - *Erect Macrophytes* - macro algae with an erect growth form and high level of cellular differentiation e.g. *Sargassum, Caulerpa* and *Galaxaura* species
    - *Erect Calcareous* - algae with erect growth form and high level of cellular differentiation containing calcified segments e.g. *Halimeda* species
    - *Filamentous* - thin thread like algae with little cellular differentiation.
    - *Encrusting* - algae growing in sheet like form attached to substrate or benthos e.g. coralline algae.
    - *Turf Mat* - algae that forms a dense mat or turf on the substrate.
4. **Sediment type** – A one-litre Van Veen grab was used to obtain a sediment sample at each site. Grain size categories were then identified visually as; shell grit, rock, gravel shell grit, rock, gravel (>2000µm), coarse sand (>500µm), sand (>250µm), fine sand (>63µm) and mud (<63µm).
5. **Site details** – Including location by GPS, weather conditions at the time of sampling and depth below mean sea level (MSL)

Plate 1. Offshore video sampling sled, Van Veen sediment grab and sorting benthic samples from the sled net

Habitat mapping and Geographic Information System

All survey data were entered into a Geographic Information System (GIS) for presentation of marine plant information. Rectified satellite images of the area assisted with mapping. Other information including depth below mean sea level (dbMSL), substrate type, and the shape of existing geographical features such as reefs and channels was also interpreted and used in determining habitat boundaries.

Five types of GIS layers were created in ArcGIS® to describe Dugong Sanctuary seagrasses:

- **Habitat characterisation sites** – point data recorded at the start of each transect containing percent cover of seagrass, above ground biomass (for each species), algae and benthic macro-invertebrate percent cover and proportion of functional group, dbMSL, sediment type, time, latitude and longitude from GPS fixes, sampling method and any comments.
- **Seagrass meadow area** – area data for seagrass meadows with summary information on meadow characteristics.
- **Seagrass biomass and density** – seagrass percent cover for each seagrass meadow and biomass of individual species within seagrass meadows.
- **Algae area** – area data for algae meadows with summary information on meadow characteristics.
- **Algae density** – algae percent cover for each meadow.

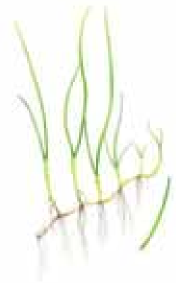
Each seagrass and algae meadow was assigned a mapping precision estimate (±m) based on the mid-point between the last site where seagrass was present and the next non-seagrass site, as well as topographical changes in seafloor structure (i.e. reef tops versus deepwater channels). The mapping precision estimate was used to calculate a range of meadow area for each meadow and was expressed as a meadow reliability estimate (R) in hectares. Additional sources of mapping error associated with digitising aerial photographs onto basemaps and with GPS fixes for survey sites were embedded within the meadow reliability estimates.

Seagrass and algae percent cover and seagrass species biomass layers were generated from an ArcGIS® spatial analyst tool in which habitat survey sites are interpolated. Interpolating is a method of calculating a new point between two or more existing points (i.e. two habitat survey sites). A type of interpolation called Inverse Distance Weighted (IDW) was applied to seagrass and algae meadows generated (as described above). This then estimates new values among habitat survey sites by taking a weighted average of seagrass cover or biomass from surrounding habitat survey sites (i.e. in the neighbourhood). The weighted average calculated for each new point diminishes as the distance from the new point to the habitat survey sites increases. This tool provides an indication of the likely spread of seagrass and algae (percent cover or species biomass) across a meadow based on the coverage of habitat survey sites and the relationship of the values among sites.

RESULTS

Seagrass species, distribution and abundance

A total of six seagrass species (from 2 families) were identified in the survey area in March 2010:

Family	Species			
CYMODOCEACEAE Taylor	*Cymodocea serrulata* (R.Br.) Aschers and Magnus		*Halodule uninervis* (wide leaf morphology) (Forsk.) Aschers. in Boissier	 (wide)
	Syringodium isoetifolium (Ashcers.) Dandy			
HYDROCHARITACEAE Jussieu	*Halophila decipiens* Ostenfield		*Halophila ovalis* (R. Br.) Hook. F.	
	Halophila spinulosa (R. Br.) Aschers. in Neumayer			

A total of 132 subtidal habitat characterisation transects were surveyed in March 2010. Seagrass was found at 73% of sites surveyed with most seagrass found associated with sandy substratum's (Map 1). One large seagrass meadow of 875,244 ± 159,190 ha was mapped as a result of the baseline survey (Map 2) with an average percent cover of 6%. Mean above-ground biomass of the seagrass meadow was 2.03 ± 0.51 g DW m^{-2}.

There were four seagrass density hotspots identified where percent cover was between 40-55% of the substratum: one directly west of Badu Island; a cluster of high density regions located west of the passage between the Prince of Wales Island and the Queensland mainland; one to the south of Cook Reef; and the final one located near the depth limit of seagrasses to the west-sou-west of

Cook Reef (Map 2). Most seagrass was found on substrates dominated by sand/shell and mud. Seagrass appeared to be depth limited to just under 30m at its western edge and no seagrass was found in depths greater than 29.7m below Mean Sea Level.

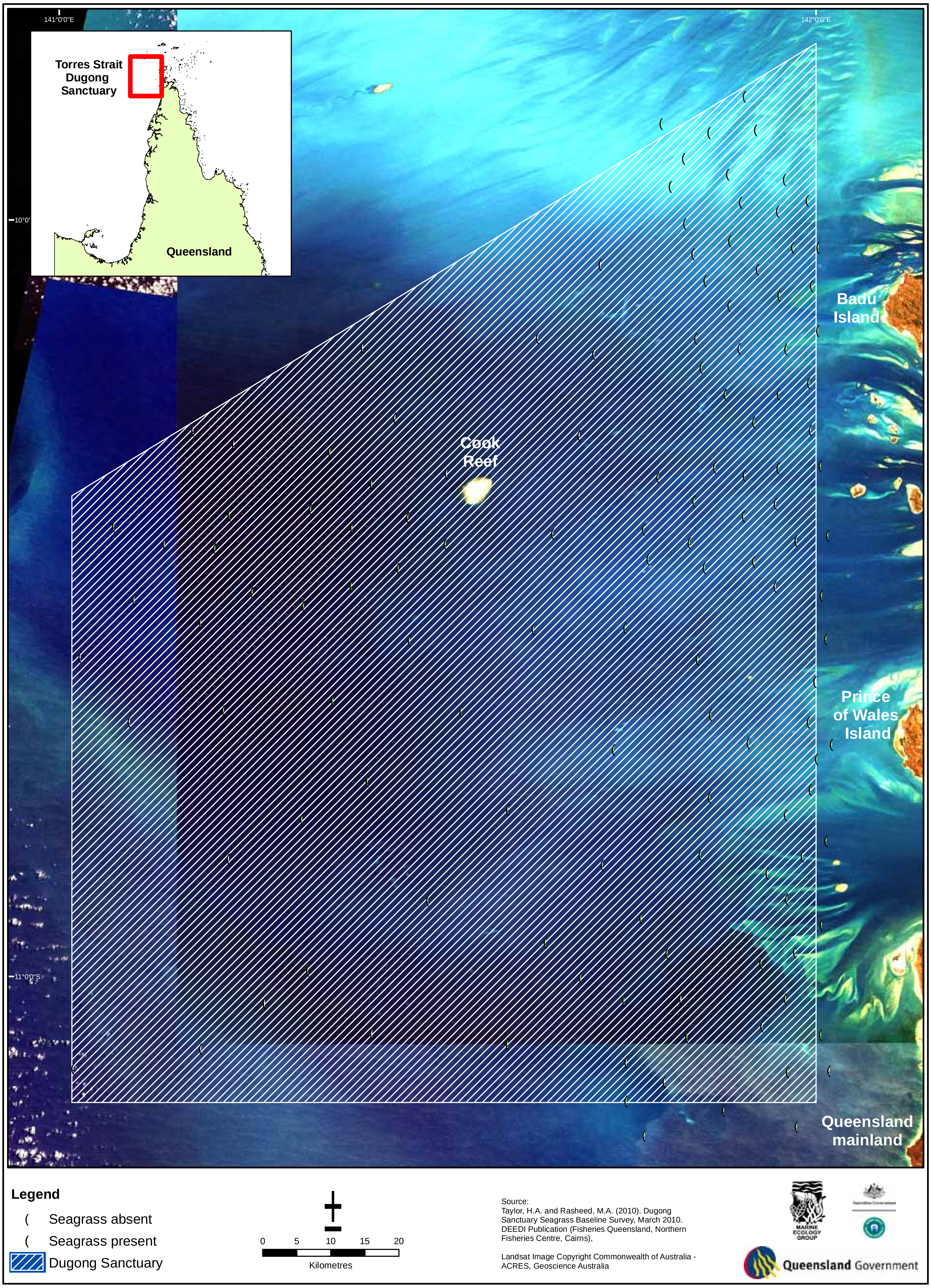
The most abundant species (i.e. greatest biomass) throughout the meadow was *Halophila spinulosa* followed by *Cymodocea serrulata* and *Halophila ovalis* (Map 3). The three other species identified, *Syringodium isoetifolium, Halodule uninervis* (wide) and *Halophila decipiens* were found at a limited number of survey sites and did not account for a significant proportion of the seagrass meadow composition[1]. *Halophila spinulosa* was densest west of the passage between Prince of Wales Island and the Queensland mainland where biomass peaked at a high of 37.6 g DW m^{-2}. There were two further high density regions located west of Badu Island and near the north-eastern meadow boundary. *Cymodocea serrulata* and *Halophila ovalis* were found in very low abundance (<0.5 g DW m^{-2}) throughout the seagrass meadow, except for in the south-east corner where *Halophila ovalis* was absent. *Cymodocea serrulata* was at its greatest density surrounding Cook Reef, whilst *Halophila ovalis* had a number of patches throughout the meadow in which biomass was elevated (Map 3).

Macroalgae distribution and abundance

In addition to seagrass, macroalgae formed significant areas of habitat within the Dugong Sanctuary. Five structurally distinct types of algae were identified: erect macrophytes, erect calcareous, filamentous, turf mat and encrusting algae. Percent cover of algae was typically very low (<10%), however there were a number of locations in which cover was nearing 50% including one directly south of Cook Reef, one located at the midpoint between Cook Reef and the Central Islands and one in deeper waters to the west of Cook Reef (Map 4). High percent cover algae hotspots did not overlap with seagrass hotspots.

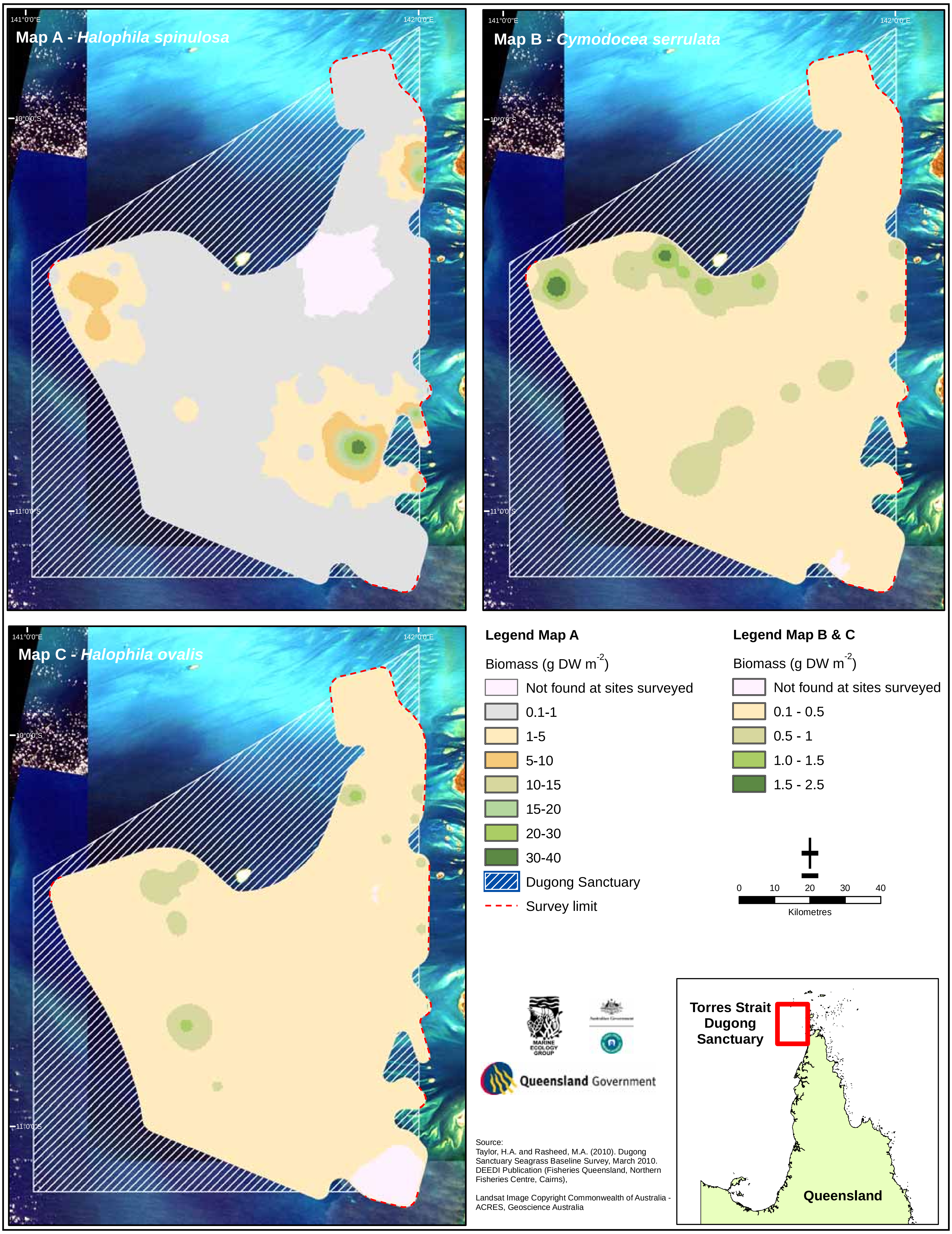
[1] Less abundant species are not represented in attached maps.

Map 1 Location of baseline 2010 seagrass assessment sites, Dugong Sanctuary, Torres Strait

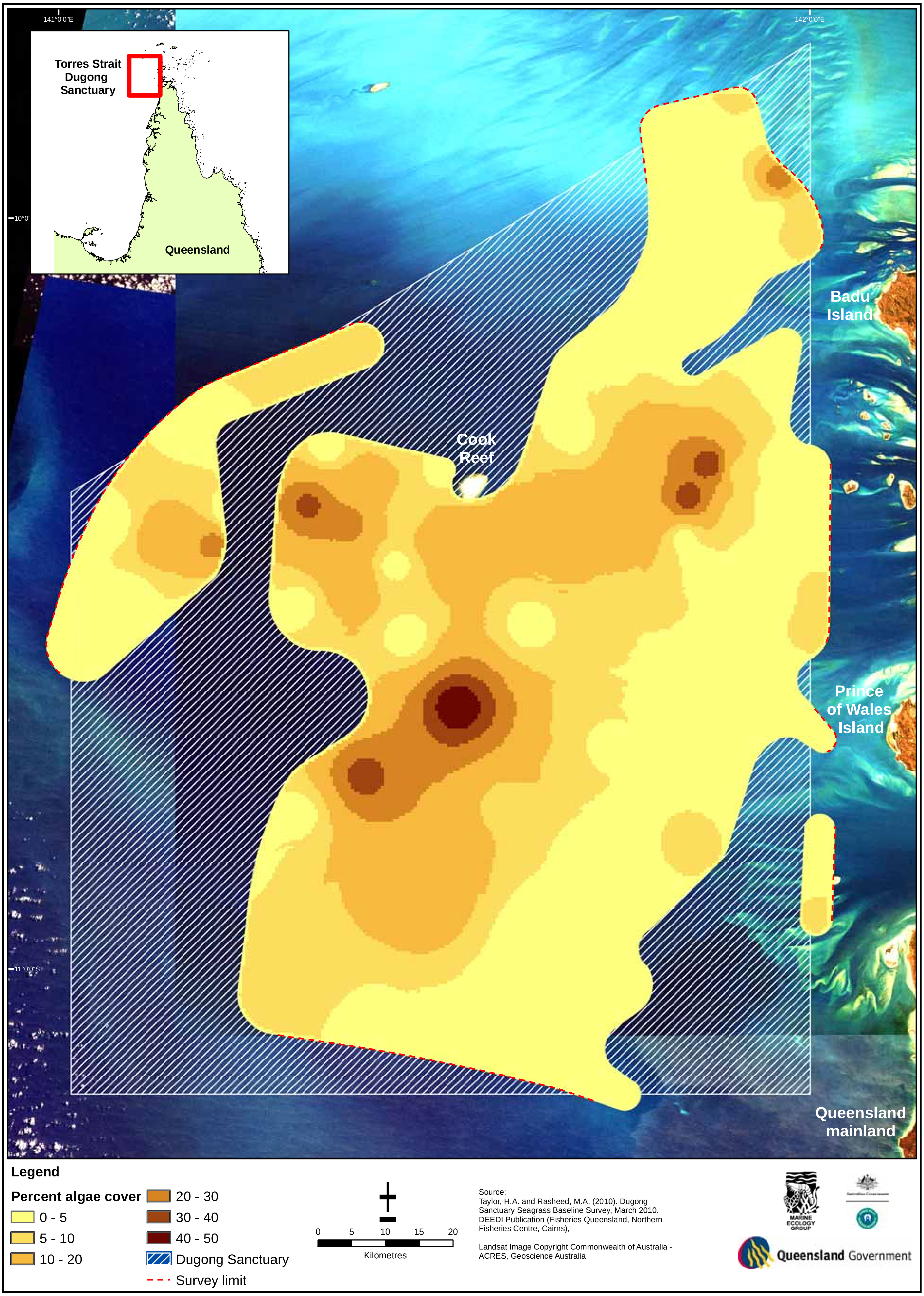


Map 2 Seagrass meadow location and percent cover, Dugong Sanctuary, Torres Strait 2010

Map 3 Seagrass abundance by species, Dugong Sanctuary, Torres Strait 2010



Map 4 Algae meadows location and percent cover, Dugong Sanctuary, Torres Strait, 2010



DISCUSSION

The March 2010 baseline survey was the most comprehensive assessment of seagrass distribution and abundance that has been conducted within the Dugong Sanctuary. The Sanctuary contained the largest single continuous seagrass meadow recorded in Australia and was likely to provide an important food resource for dugong and turtle populations. Seagrass species found included those known to be important for dugong and turtles as well as nursery grounds for commercial fisheries species. The seagrass found in the sanctuary was likely to vary considerably in distribution and abundance seasonally and between years which will have implications for its use as a resource by dugong. A longer term seagrass monitoring program in the sanctuary is recommended to aid in dugong and turtle management plans and the assessment of the effectiveness of the Dugong Sanctuary.

Seagrass distribution and abundance

The 875,000+ ha of seagrass described in the Dugong Sanctuary is the largest recorded area for a single continuous seagrass meadow within Australia. Previously, Shark Bay in Western Australia held the record at 400,000+ ha (Walker et al. 1988), less than half the area recorded in the Dugong Sanctuary. The area of seagrass within this region of the Torres Strait is likely to be much greater than reported here, as seagrass was found to the edge of our survey limit and likely continued beyond. The sanctuary seagrass meadow was significant from a regional perspective being several orders of magnitude greater in area than nearby subtidal seagrasses that have been described, such as Mabuiag Island (19,517 ha) (Chartrand et al. 2009) and Badu Island (3,363 ha) (Taylor & Rasheed 2010).

The large seagrass meadow was dominated by *Halophila spinulosa,* which is typical for subtidal seagrass meadows in the Indo-West Pacific region (Coles et al. 2000; Lee Long et al. 1996). The diversity of seagrass species, while lower than nearby shallow coastal areas, was relatively high for deeper water regions, and contained 37% of the species known in Queensland waters (Coles et al. 2007). Generally deepwater seagrass communities are limited to species capable of growing under low light conditions and the species mix in the sanctuary seagrass meadow generally reflects these constraints. Change in the availability of light with increasing depth is a major factor shaping the distribution of subtidal seagrasses (Short et al. 2001; Erftemeijer and Herman 1994; Taylor et al. 2007; Rasheed et al. 2007a; Rasheed et al. 2007b). *Halophila* species for example, are well adapted to lower light conditions and typically dominate low light environments such as deepwater and highly turbid areas (Kenworthy et al. 1989; Chartrand et al. 2008).The depth that seagrasses occurred within the sanctuary appeared to be limited to approximately 30m below MSL with *Halophila* species dominating at these depths. However, the presence of higher light requiring species such as *Cymodocea serrulata* (to 26.8m below MSL) and *Syringodium isoetifolium* (to 20m below MSL) in deepwater areas indicates that water clarity and light penetration is relatively good in the sanctuary.

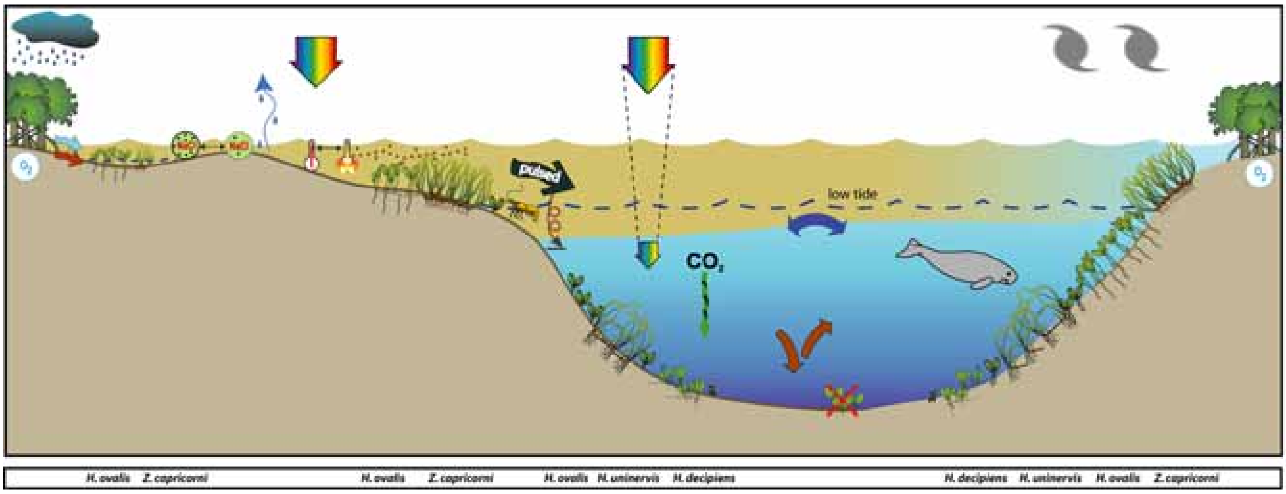


Figure 3 General conceptual model of seagrass habitats occurring within the Bustard Bay region (from Coles *et al.* 2007; see Appendix 1 for symbol explanation).

Seasonality and inter-annual change

Many of the factors that influence seagrass growth vary seasonally, and also change between years. This leads to tropical seagrass meadows varying substantially in density and area between seasons (Rasheed 1999; 2004; Rasheed and Unsworth 2010; McKenzie 1994) as well as between years (eg. Chartrand et al. 2008; Rasheed et al. 2007a; 2007b). Seagrasses of tropical Queensland are generally at their peak in distribution and abundance during late spring/early summer and decline during winter months (Mellors et al. 1993; McKenzie 1994; Rasheed 1999; 2004). Seagrasses in the Dugong Sanctuary were therefore likely just past their peak seasonal distribution and abundance at the time of the baseline survey.

The causes of natural seasonal change in seagrass are linked to a variety of factors, but broadscale seasonal patterns are most likely the result of seasonality in light and temperature (Duarte et al. 2006). In the Great Barrier Reef World Heritage Area (GBRWHA), seagrasses flourish from August to November, when sediment resuspension is at its lowest, light levels are higher and nutrient fluctuations are minimised. Post wet season, increases in turbidity from river inputs and greater resuspension of sediments causes light levels to drop and nutritent fluctuations are larger, leading to a decrease in seagrass growth (Coles et al. 2007; Mellors 2003). While light and temperature are important, other influences such as seasonally available nutrient inputs from wet season floods, changes to salinity and daytime exposure may also influence seagrass seasonal and interannual patterns of change (Figure 4). It is likely that many of the same drivers of change in the GBRWHA would apply to Torres Strait seagrasses. However, the highly exposed nature of the Dugong Sanctuary means that seasonal differences in wind, waves and storms leading to sediment resuspension and low light are likely to play a significant role in driving seagrass seasonal change.

In addition to seasonal change, local and regional climate conditions in Queensland are well documented to affect seagrass abundance and distribution from year to year (Taylor et al. 2007; Rasheed et al. 2007a; Rasheed et al. 2007b). Typically, when local climate conditions are in a drought-like state, intertidal seagrasses decline due to exposure to high temperatures and increased desiccation, whilst subtidal seagrasses thrive due to higher light levels reaching the bottom (Taylor et al. 2007; Rasheed et al. 2007a; Rasheed et al. 2007b). The opposite is generally true when conditions are within “normal” ranges.

The extent of seasonal and interannual changes for the Dugong Sanctuary’s seagrasses are likely to be high as meadows dominated by *Halophila* species are more likely to show high variability in location, shape and abundance between seasons as has been recorded in other Queensland locations (eg. Abbot Point – McKenna et al. 2008; Hay Point – Chartrand et al. 2008; Weipa –

Roelofs et al. 2001; Mourilyan Harbour – McKenna et al. 2007; Karumba – Rasheed & Taylor 2007). *Halophila* species display a typical colonising growth strategy with fast growth and high reproductive output (Birch & Birch 1984; Rasheed 2004) including the production of long lived seeds that remain viable in sediments (McMillan 1991). They can rapidly colonise areas that have been disturbed but due to their small size, they lack large stores of energy reserves and rapidly decline when conditions become unfavorable for seagrass growth (Birch & Birch 1984; Rasheed 2004).

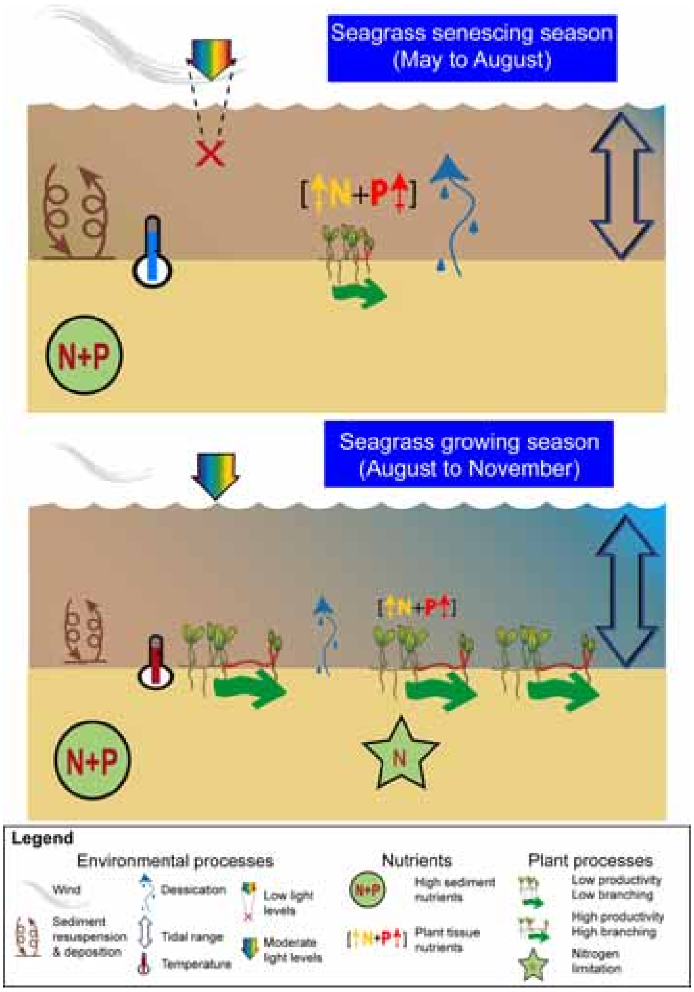


Figure 4 Conceptual diagram of controls and key processes limiting growth between seasons of intertidal *Halophila ovalis* (from Mellors 2003)

Value of Dugong Sanctuary seagrasses

Results from this baseline survey indicate that the location of the Dugong Sanctuary is appropriate from a seagrass perspective with the majority of the area containing seagrass that would be suitable as a food resource for dugong. The large area of seagrasses mapped also provides an important source of primary production supporting the regions marine ecosystem. Recent studies at the Orman Reefs, Torres Strait, have shown seagrass meadows to be incredibly productive, completely turning over their above ground biomass every 9 to 25 days (Rasheed et al. 2008).

The large area of seagrass mapped in the Dugong Sanctuary is potentially an important food resource for dugong and turtle populations. The region contains the largest population of dugongs in Australia and possibly the world (Marsh and Kwan 2008). Sheppard et al. (2008) identified seagrasses in the Dugong Sanctuary to be of a high nutritional value to dugong and are likely to be more nutritious to dugong than seagrass in other Torres Strait locations. Further work would be required to assess the degree to which dugong and turtles utilise the seagrasses within the Sanctuary. While no dugongs were sighted during the survey, frequent sightings of dugongs and turtles feeding, and large numbers of dugong feeding trails have been recorded in many of the intertidal seagrass meadows at nearby Mabuiag, Badu and Moa Islands (Chartrand et al. 2009 Taylor & Rasheed 2010).

Seagrass meadows in Queensland are also essential nursery grounds for a range of commercial prawn and fish species. They provide shelter for juveniles and small adults from larger fish predators as well as an essential food source. Intertidal and shallow subtidal seagrasses in Cairns Harbour have been valued at $1.2m per year in 1992 Australian dollars to the local industry (Watson et al. 1993). The Torres Strait region supports a multi-species prawn fishery with many commercial prawn species relying on seagrasses for part of their life cycle (Coles et al. 1992). The Dugong Sanctuary falls within the ‘West of Warrior Reef’ exclusion zone within which the taking of prawns has been permanently prohibited to help protect juveniles.

Vulnerability of seagrasses within the Dugong Sanctuary

There has been evidence of widespread and prolonged dieback of intertidal and deepwater seagrasses in the Torres Straits during the early 1970’s (Johannes and MacFarlane 1991) and localised episodic dieback events in the north-western Torres Strait in 1991-1992 (Poiner and Peterken 1996) and the Orman Reefs in 1999-2000 (Marsh et al. 2004). While scientific data on the cause of these declines is limited, the dieback events were largely believed to be as a result of natural environmental events including pulsed turbidity from river flooding, overgrazing by dugongs and turtles and sediment resuspension (Marsh and Kwan 2008).

Most of the species present in the Dugong Sanctuary have a capacity for rapid vegetative colonisation following disturbance (Rasheed 1999; 2004). However environmental conditions, such as cyclones, have the potential to significantly reduce the capacity of seagrass meadows to recover and hence their natural levels of resilience to future impacts. This would especially be the case if similar conditions persisted over multiple years that depleted seagrass energy stores, seed banks and standing crop. Under this scenario seagrasses could become increasingly vulnerable to impacts they may previously have been resilient to.

The baseline survey and proposed monitoring program provide a reference point to assess future seagrass changes and levels of resilience, as well as developing an appreciation of the natural ranges of seagrass change. This information will allow the development of effective management options to protect these valuable habitats and information on potential flow on effects to dugong and turtle relying on these seagrasses as a food resource.

Proposed monitoring program

While the results of this survey indicate that seagrass communities within and around the Dugong Sanctuary appear healthy, detailed historical comparisons were not possible as this was the first detailed survey of the area. In addition, the lack of seasonal baseline data makes it difficult to determine the extent of the natural seasonal and inter-annual change for seagrasses in the region. Without this information, it is difficult to discern any future natural changes from anthropogenic influenced changes. Further surveys of seagrasses in the region would be highly valuable given the likely importance of this habitat to dugong and turtle and the regional importance to local commercial fisheries. Regular seagrass monitoring would give a better picture of the health of the seagrass habitat.

A two-part monitoring program for the Dugong Sanctuary has been developed:

1. A seasonal baseline survey of representative areas within the sanctuary; and
2. Developing a long-term community monitoring program where assessment of permanent sites would be conducted by Torres Strait Rangers and Dugong and Turtle Officers, with the assistance of the Marine Ecology Group.

Surveying during the wet and dry seasons will provide information on seasonal change patterns and their likely impacts to dugong and turtle feeding. Long-term community monitoring of selected areas of the dugong sanctuary would allow us to determine how seagrasses change from year to year in relation to local climate and weather patterns and feed this information into dugong and turtle management plans. The monitoring program has been funded by the TSRA in 2010/2011, with work set to begin in October 2010.

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APPENDIX 1

Key to symbols used for the conceptual diagram (from Coles et al. 2007).